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Exercise - I (Conceptual Questions) Build Up Your Understanding

TRIGONOMETRY

1. As θ increases from 0° to 90°, the value of sinθ :-
(1) Increases
(2) Decreases
(3) Remains constant
(4) First decreases then increases.

2. If $\sin\theta = \frac{\sqrt{2}}{\sqrt{3}}$ and θ lies in the first quadrant, the value of tan θ is :
(1) $\sqrt{2}$ (2) $\frac{1}{\sqrt{2}}$ (3) $\frac{\sqrt{3}}{\sqrt{2}}$ (4) $\frac{1}{2}$

3. Find θ for which sinθ = cosθ, if 180° < θ < 360°
(1) 135° (2) 315°
(3) 225° (4) 150°

4. If $\sin\theta_1 + \sin\theta_2 + \sin\theta_3 = 3$
then value of $\cos\theta_1 + \cos\theta_2 + \cos\theta_3$ is :-
(1) 3 (2) 0 (3) –3 (4) 1

5. If $\tan(2A+B)=\sqrt{3}$ and $\cot(3A-B)=\sqrt{3}$.
Find A and B.
(1) 18°, 24° (2) 24°, 18°
(3) 20°, 20° (4) 18°, 36°

6. Value of $\sin^2 15° + \sin^2 30° + \sin^2 45° + \sin^2 60° + \sin^2 75°$ is :-
(1) 1 (2) $\frac{3}{2}$ (3) $\frac{5}{2}$ (4) 3

7. Value of $\sin(45°+\theta)\cos(15°+\theta) - \cos(45°+\theta)\sin(15°+\theta)$ is :-
(1) 1 (2) $\frac{3}{2}$
(3) $\frac{1}{2}$ (4) $-\frac{1}{2}$

8. Value of $\sin(-420°)\cos(390°) + \cos(-660°)\sin(330°)$ is :-
(1) 0 (2) –1 (3) 0 (4) $\frac{3}{2}$

9. Value of (tan1° tan2° tan3°.....tan89°) is :-
(1) 0 (2) 1 (3) 2 (4) $\frac{1}{2}$

10. The greatest value of the function 7 sinθ – 24 cosθ is
(1) 12 (2) 13 (3) 25 (4) 17

11. The length of hypotenuse of a right angle triangle exceeds the length of its base by 2 cm and exceeds twice the length of altitude by 1 cm. Find length of each side of the triangle.
(1) 6, 8, 10 (2) 7, 24, 25
(3) 8, 15, 17 (4) 7, 40, 41

CALCULUS

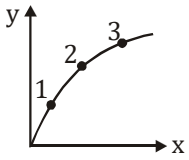
12. If $x = at^4$ and $y = bt^3$. Find $\frac{dy}{dx}$
(1) $\frac{4a}{3bt}$ (2) $\frac{3b}{4at}$ (3) $\frac{3a}{4bt}$ (4) $\frac{4b}{3at}$

13. A metallic disc is being heated. Its area at any time t is given by $A = 5t^2 + 4t + 8$. Calculate rate of increase in area at t = 3s.
(1) 30 m^2/s (2) 34 m^2/s
(3) 28 m^2/s (4) 20 m^2/s

14. The side of a square is increasing at the rate of 0.1 cm/s. The rate of increase of perimeter w.r.t. time is :
(1) 0.2 cm/s (2) 0.4 cm/s
(3) 0.6 cm/s (4) 0.8 cm/s

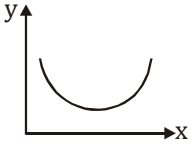
15. A particle moves along the straight line 3y =x+5. Which coordinate changes at a faster rate ?
(1) x–coordinate
(2) y–coordinate
(3) Both x and y coordinates
(4) Data insufficient.

16. The slope of graph as shown in figure at points 1, 2 and 3 is m_1, m_2 and m_3 respectively then



(1) $m_1 > m_2 > m_3$ (2) $m_1 < m_2 < m_3$
(3) $m_1 = m_2 = m_3$ (4) $m_1 = m_3 > m_2$

17. Magnitude of slope of the shown graph.



(1) First increases then decreases
(2) First decreases then increases
(3) Increases
(4) Decreases

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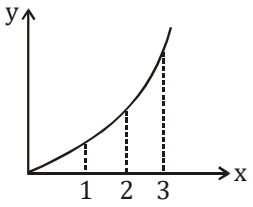
18. Calculate the area enclosed under the curve $f(x) = x^2$ between the limits x = 2 and x = 3



(1) 5 (2) $\frac{19}{3}$ (3) $\frac{17}{3}$ (4) 8

19. Find the value of $\int_0^4 |(1-x)|.dx$

(1) zero (2) 1 (3) 4 (4) 5

GEOMETRY & GRAPHS

20. The equation of a curve is given as $y = x^2 + 2 - 3x$. The curve intersects the y-axis at

(1) (1, 0) (2) (2, 0)
(3) (0, 2) (4) No where

21. Two particles A and B are moving in XY-plane. Their positions vary with time t according to relation :

$x_A(t) = 3t$, $x_B(t) = 6$
$y_A(t) = t$, $y_B(t) = 2 + 3t^2$

Distance between two particles at t = 2 is :

(1) 12 (2) 13 (3) 5 (4) $\sqrt{12}$

22. The distance between points (a + b, b + c) and (a – b, c – b) is :-

(1) $2\sqrt{a^2+b^2}$ (2) $2\sqrt{b^2+c^2}$
(3) $2\sqrt{2}b$ (4) $\sqrt{a^2-c^2}$

23. A dog is at point A(0, 3, 4)m and cat is at B(5,3,–8)m The dog is free to move but cat is fixed. The minimum distance travelled by dog to catch the cat is :-

(1) 25m (2) 12m (3) 13m (4) 20m

24. A particular straight line passes through origin and a point whose abscissa is equal to ordinate. The equation of such straight line is :

(1) y = x (2) y = 2x
(3) y = –4x (4) $y = -\frac{x}{4}$

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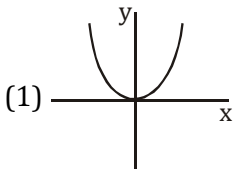
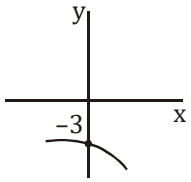
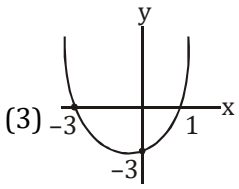
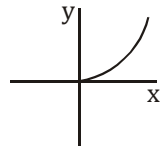
25. If $y = x^2 + 2x - 3$, then y-x graph is :-

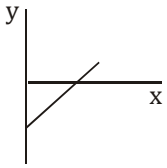
(1) 

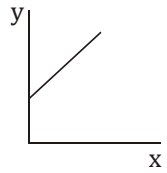
(2) 

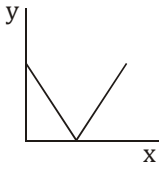
(3) 

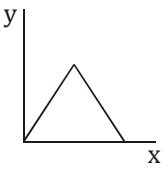
(4) 

26. If y =|x–1|, then y-x graph is :-

(1) 

(2) 

(3) 

(4) 

27. The coordinates of a particle moving in XY–plane vary with time x = a cosωt, y = a sinωt. The locus of the particle is a :-

(1) Straight line (2) Circle
(3) Parabola (4) Ellipse

28. Frequency f of a simple pendulum depends on its length ℓ and acceleration g due to gravity according to the following equation $f = \frac{1}{2\pi}\sqrt{\frac{g}{\ell}}$. Graph between which of the following quantities is a parabola ?

(1) f on the ordinate and $1/\ell$ on the abscissa
(2) f on the ordinate and $\sqrt{\ell}$ on the abscissa
(3) f^2 on the ordinate and ℓ on the abscissa
(4) f^2 on the ordinate and $1/\ell$ on the abscissa

ALGEBRA

29. The sum of the series $1 + \frac{1}{3} + \frac{1}{9} + \frac{1}{27} + ...\infty$ is :-

(1) $\frac{8}{7}$ (2) $\frac{6}{5}$ (3) $\frac{2}{3}$ (4) $\frac{3}{2}$

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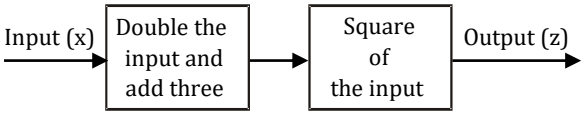
30. In the given figure, each box represents a function machine. A function machine illustrates what it does with the input.



Which of the following statements is correct ?

(1) $z = (2x+3)^2$ (2) $z = 2(x+3)$

(3) $z = \sqrt{2x+3}$ (4) $z = \sqrt{2(x+3)}$

DEFINITION & TYPES OF VECTOR

31. Which of the following statements is false :

(1) Mass, speed and energy are scalars

(2) Momentum, force and torque are vectors

(3) Distance is a vector while displacement is a scalar

(4) A scalar has only magnitude whereas as a vector has both magnitude and direction

32. A physical quantity which has a direction and obeys triangle law of vector addition :

(1) must be a vector (2) may be a vector

(3) must be a scalar (4) none of the above

33. The forces, which meet at one point and their lines of action lie in one plane, are called :

(1) non-concurrent and non-coplanar forces

(2) non-concurrent and coplanar forces

(3) concurrent and non-coplanar forces

(4) concurrent and coplanar forces

34. Which of the following physical quantities is not an axial vector ?

(1) angular velocity

(2) angular momentum

(3) velocity

(4) torque

35. The direction of the angular velocity vector is along :

(1) Along the tangent of circular path

(2) Along the direction of radius vector

(3) Opposite to the direction of radius vector

(4) Along the axis of rotation

36. If $\hat{n}$ is a unit vector in the direction of the vector $\vec{A}$, then :-

(1) $\hat{n} = \frac{\vec{A}}{|\vec{A}|}$ (2) $\hat{n} = \vec{A}|\vec{A}|$

(3) $\hat{n} = \frac{|\vec{A}|}{\vec{A}}$ (4) None of the above

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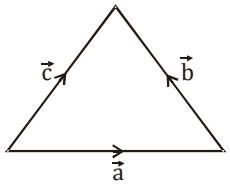
ADDITION & SUBTRACTION, MULTIPLICATION & DIVISION OF A VECTOR BY A SCALAR

37. In the given figure, $\vec{a}+\vec{b}+\vec{c}$ is



(1) $2\vec{a}$ (2) $2\vec{b}$ (3) $2\vec{c}$ (4) $\vec{a}+\vec{b}$

38. Vector sum of two forces of 10N and 5N can be :

(1) 4N (2) 18N (3) 12N (4) 2N

39. The vector sum of the forces of 10 newton and 8 newton cannot be :

(1) 2N (2) 8N (3) 18N (4) 20N

40. Which of the following pair of forces can give a resultant force of 2 N ?

(1) 1 N and 2 N (2) 1 N and 5 N

(3) 2 N and 5 N (4) 1 N and 4 N

41. Two vectors of equal magnitude have a resultant equal to either of them in magnitude. The angle between the vector is :

(1) 60° (2) 90°

(3) 105° (4) 120°

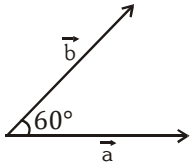
42. $\vec{R} = \vec{a} + \vec{b}$, where $\vec{R}, \vec{a}$ and $\vec{b}$ are non-zero vector.

If R = a = b, the angle between $\vec{R}$ and $\vec{a}$ is :-

(1) $\frac{\pi}{3}$ (2) $\frac{2\pi}{3}$

(3) $\frac{\pi}{4}$ (4) $\frac{\pi}{6}$

43. If resultant of two vectors $\vec{a}$ and $\vec{b}$ shown in the figure is $\sqrt{7}\,b$, then value of $\frac{b}{a}$ is :-



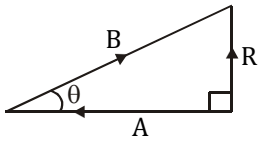
(1) $\frac{1}{2}$ (2) 1 (3) 2 (4) 3

44. If $\vec{A}+\vec{B}=\vec{C}$ and A + B = C, then the angle between $\vec{A}$ and $\vec{C}$ is :

(1) 0 (2) $\frac{\pi}{4}$ (3) $\frac{\pi}{2}$ (4) π

45. Two vectors $\vec{A}$ and $\vec{B}$ are such that $\vec{A}+\vec{B}=\vec{C}$ and A – B = C. Which of the following statements, is correct ?
(1) $\vec{A}$ is parallel to $\vec{B}$
(2) $\vec{A}$ is anti-parallel to $\vec{B}$
(3) $\vec{A}$ is perpendicular to $\vec{B}$
(4) $\vec{A}$ and $\vec{B}$ are equal in magnitude

46. In vector diagram shown in figure where $(\vec{R})$ is the resultant of vectors ($\vec{A}$) and ($\vec{B}$).
If R = $\frac{B}{2}$, then value of angle θ is :



(1) 30° (2) 45° (3) 60° (4) 75°

47. The resultant of $\vec{A}$ and $\vec{B}$ makes an angle α with $\vec{A}$ and β with $\vec{B}$, then :
(1) α < β (2) α < β if A < B
(3) α < β if A > B (4) α < β if A = B

48. If two forces of equal magnitude acting on a particle. The angle between forces is 60°. The resultant force on the particle is :-
(1) at an angle of 30° with each force.
(2) at an angle of 45° with one of the force
(3) at an angle of 15° with one of the force
(4) at an angle lying between 45° to 60°

49. The resultant of $\vec{A}$ and $\vec{B}$ is perpendicular to $\vec{B}$. What is the angle between $\vec{A}$ and $\vec{B}$?
(1) $\cos^{-1}\left(\frac{A}{B}\right)$ (2) $\cos^{-1}\left(-\frac{B}{A}\right)$
(3) $\sin^{-1}\left(\frac{A}{B}\right)$ (4) $\sin^{-1}\left(-\frac{A}{B}\right)$

50. The resultant of two forces make 30° and 60° angles with them and has magnitude 40 N. The magnitudes of two vectors are :-
(1) $20\sqrt{3}$ N, 20N (2) 30N, $20\sqrt{3}$ N
(3) 40N, 30N (4) $3\sqrt{3}$ N, $40\sqrt{3}$ N

51. Given that $\vec{P}+\vec{Q}=\vec{P}-\vec{Q}$. This can be true when:
(1) $\vec{P}=\vec{Q}$
(2) $\vec{Q}=\vec{0}$
(3) Neither $\vec{P}$ nor $\vec{Q}$ is a null vector
(4) Data Insufficient

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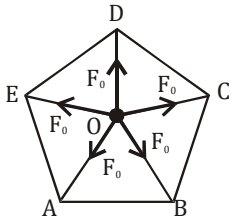
52. The resultant of $\vec{A}$ & $\vec{B}$ is $\vec{R}_1$. On reversing the vector $\vec{B}$, the resultant becomes $\vec{R}_2$. What is the value of $2(R_1^2+R_2^2)$?
(1) $4(A^2+B^2)$ (2) A^2-B^2
(3) $2(A^2+B^2)$ (4) $2(A^2-B^2)$

53. If vectors $\vec{A}$ and $\vec{B}$ are such that $|\vec{A}+\vec{B}| = |\vec{A}|=|\vec{B}|$, then $|\vec{A}-\vec{B}|$ may be equated to
(1) $\frac{\sqrt{3}}{2}|\vec{A}|$ (2) $|\vec{A}|$
(3) $\sqrt{2}|\vec{A}|$ (4) $\sqrt{3}|\vec{A}|$

54. If the difference of two unit vectors is a unit vector, then the magnitude of their sum is :
(1) $\sqrt{2}$ (2) $\sqrt{3}$
(3) $\frac{1}{\sqrt{2}}$ (4) $\sqrt{5}$

55. In the given figure, O is the centre of the regular pentagon ABCDE. Five forces each of magnitude F_0 are acted as shown in the figure. The resultant force is :-



(1) 5 F_0 (2) 5 F_0 cos72°
(3) 5 F_0 sin72° (4) zero

56. Two vectors $\vec{A}$ and $\vec{B}$ lie in a plane, another vector $\vec{C}$ lies in the same plane, then the resultant of these three vectors i.e. $\vec{A}+\vec{B}+\vec{C}$:
(1) may be zero
(2) cannot be zero
(3) lies in the plane containing $\vec{A}$ & $\vec{B}$
(4) Both 1 & 3

57. Which of the following sets of concurrent forces may be in equilibrium ?
(1) F_1 = 3N, F_2 = 5N, F_3 = 1N, F_4 = 10N
(2) F_1 = 3N, F_2 = 5N, F_3 = 9N, F_4 = 4N
(3) F_1 = 3N, F_2 = 5N, F_3 = 6N, F_4 = 15N
(4) F_1 = 3N, F_2 = 5N, F_3 =15N, F_4 = 5N

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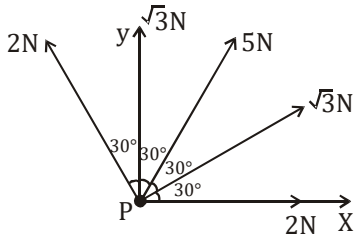
58. Five forces 2N, $\sqrt{3}$N, 5N, $\sqrt{3}$N and 2N respectively act at a particle P as shown in the figure.



The resultant force on the particle P is.

(1) 10 N making angle 60° with x-axis.

(2) 10 N making angle 60° with y-axis.

(3) 20 N along y-axis

(4) None of these

59. If $\vec{a}+\vec{b}+\vec{c}=0$. The angle between $\vec{a}$ and $\vec{b}$, $\vec{b}$ and $\vec{c}$ are 150° and 120°, respectively. Then, the magnitude of vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$ are in ratio of :-

(1) 1 : 2 : 3 (2) 1 : 2 : $\sqrt{3}$

(3) $\sqrt{3}$: 2 : 1 (4) 2 : $\sqrt{3}$: 1

60. The magnitudes of vectors $\vec{A}$, $\vec{B}$ and $\vec{C}$ are respectively 7, 24 and 25 units and $\vec{A}+\vec{B}=\vec{C}$, then the angle between $\vec{A}$ and $\vec{B}$ is :

(1) 0 (2) $\pi/3$

(3) $\pi/2$ (4) $\pi/4$

61. If vectors $\vec{P}$, $\vec{Q}$ and $\vec{R}$ have magnitudes 5, 12 and 13 units and $\vec{P}+\vec{Q}=\vec{R}$, the angle between $\vec{P}$ and $\vec{R}$ is :

(1) $\cos^{-1}\left(\frac{5}{12}\right)$ (2) $\cos^{-1}\left(\frac{5}{12}\right)$

(3) $\cos^{-1}\left(\frac{12}{13}\right)$ (4) $\cos^{-1}\left(\frac{2}{13}\right)$

62. If the vectors $\left(\hat{i}+\hat{j}+\hat{k}\right)$ and $3\hat{i}$ form two sides of a triangle, then 3rd side of the triangle can be :

(1) $\sqrt{18}$ unit (2) $\sqrt{6}$ unit

(3) $\frac{3}{\sqrt{2}}$ unit (4) both 1 & 2

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63. The minimum number of vectors of equal magnitude required to produce a zero resultant is:

(1) 2 (2) 3

(3) 4 (4) more than 4

64. How many minimum number of coplanar vectors having different magnitudes can be added to give zero resultant ?

(1) 2 (2) 3 (3) 4 (4) 5

65. How many minimum number of vectors in different planes can be added to give zero resultant ?

(1) 2 (2) 3 (3) 4 (4) 5

66. What happens, when we multiply a vector by 2?

(1) direction reverses and unit changes

(2) direction remains same and magnitude is doubled

(3) direction remains unchanged and unit changes

(4) none of these

RESOLUTION OF VECTOR

67. What is the maximum number of components into which a vector can be split ?

(1) 2 (2) 3

(3) 4 (4) Infinite

68. What is the maximum number of rectangular components into which a vector can be split in its own plane ?

(1) 2 (2) 3

(3) 4 (4) Infinite

69. What is the maximum number of rectangular components into which a vector can be split in space ?

(1) 2 (2) 3

(3) 4 (4) Infinite

70. The unit vector along $\hat{i}-2\hat{j}$ is :

(1) $\frac{\hat{i}-2\hat{j}}{\sqrt{5}}$ (2) $\hat{i}+\hat{j}$

(3) $\frac{\hat{i}+\hat{j}}{\sqrt{2}}$ (4) $\frac{\hat{i}-\hat{j}}{\sqrt{5}}$

71. If $\vec{A}+\vec{B}$ is a unit vector along y-axis and $\vec{A}=\hat{i}-\hat{j}+\hat{k}$, then what is $\vec{B}$?

(1) $\hat{j}+\hat{k}$ (2) $\hat{j}-\hat{k}$

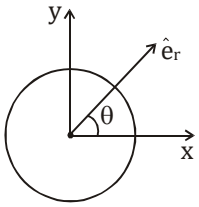
(3) $\hat{i}+\hat{j}+\hat{k}$ (4) $2\hat{j}-\hat{i}-\hat{k}$

72. If a unit vector is represented by $0.3\hat{i}-0.4\hat{j}+c\hat{k}$, then the value of 'c' is :

(1) $\sqrt{0.75}$ (2) $\sqrt{0.25}$

(3) $\sqrt{0.01}$ (4) $\sqrt{0.39}$

73. $\hat{e}_r$ is unit vector along radius of a circle shown in figure. $\hat{e}_r$ can be represented as :-



(1) $\cos\theta\hat{i}+\sin\theta\hat{j}$ (2) $\sin\theta\hat{i}+\cos\theta\hat{j}$

(3) $\cos\theta\hat{i}-\sin\theta\hat{j}$ (4) $-\cos\theta\hat{i}+\sin\theta\hat{j}$

74. Forces 7N, 24N, 25N act at a point in mutually perpendicular directions. The magnitude of the resultant force is :

(1) 19 N (2) 13 N

(3) 26 N (4) $25\sqrt{2}$ N

75. The angle that the vector $\vec{A}=2\hat{i}+3\hat{j}$ makes with x-axis is :

(1) $\tan^{-1}(3/2)$ (2) $\tan^{-1}(2/3)$

(3) $\sin^{-1}(2/3)$ (4) $\cos^{-1}(3/2)$

76. What vector must be added to the other vectors $\hat{i}-2\hat{j}+2\hat{k}$ and $2\hat{i}+\hat{j}-\hat{k}$, so that the resultant may be a unit vector along y-axis?

(1) $2\hat{i}+\hat{j}-\hat{k}$ (2) $-3\hat{i}+2\hat{j}-\hat{k}$

(3) $-2\hat{i}-\hat{j}-\hat{k}$ (4) $3\hat{i}-2\hat{j}-\hat{k}$

77. The unit vector parallel to the resultant of the vectors $\vec{A}=4\hat{i}+3\hat{j}+6\hat{k}$ and $\vec{B}=2\hat{i}-3\hat{j}+2\hat{k}$ is :

(1) $\frac{1}{10}\left[8\hat{i}+6\hat{k}\right]$ (2) $\frac{1}{10}\left[6\hat{i}+8\hat{k}\right]$

(3) $\frac{1}{10}\left[6\hat{i}+6\hat{k}+6\hat{j}\right]$ (4) $\frac{1}{10}\left[6\hat{j}+8\hat{k}\right]$

78. If $\vec{a}=2\hat{i}+2\hat{j}-\hat{k}$ and $\vec{b}=\hat{i}+\hat{j}+\hat{k}$. Find a vector $\vec{c}$ which is parallel to $\vec{a}$ but has magnitude three times that of $\vec{b}$.

(1) $\vec{c}=3\hat{i}+3\hat{j}+3\hat{k}$

(2) $\vec{c}=2\sqrt{3}\hat{i}+2\sqrt{3}\hat{j}-\sqrt{3}\hat{k}$

(3) $\vec{c}=6\hat{i}+6\hat{j}-3\hat{k}$

(4) $\vec{c}=3\hat{i}+6\hat{j}-6\hat{k}$

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79. The velocity of a particle is $\vec{v}=(\hat{i}+\hat{j}-\hat{k})$m/s. A force of $10\sqrt{3}$N parallel to velocity in vector form is :-

(1) $(10\hat{i}+10\hat{j}-10\hat{k})$N (2) $(\hat{i}+\hat{j}-\hat{k})10\sqrt{3}$N

(3) $(\hat{i}+\hat{j}-\hat{k})$N (4) None of these

80. The direction cosines of a vector $\sqrt{2}\hat{i}+\sqrt{2}\hat{j}+\hat{k}$ are:-

(1) $\frac{\sqrt{2}}{\sqrt{5}},\frac{\sqrt{2}}{\sqrt{5}},\frac{1}{\sqrt{5}}$ (2) $\frac{1}{\sqrt{5}},\frac{1}{\sqrt{5}},\frac{1}{5}$

(3) $\frac{1}{5},\frac{1}{5},\frac{1}{\sqrt{5}}$ (4) $\frac{1}{\sqrt{5}},\frac{1}{\sqrt{5}},\frac{1}{\sqrt{5}}$

81. Vector $\vec{P}$ makes angles α,β & γ with the X, Y and Z axes respectively, then $\cos^2\alpha+\cos^2\beta+\cos^2\gamma=$

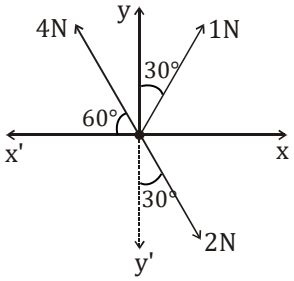
(1) 0 (2) 1 (3) 2 (4) 3

82. Find the direction cosines of vector $(\vec{a}-\vec{b})$, if $\vec{a}=2\hat{i}+3\hat{j}+\hat{k}$ and $\vec{b}=2\hat{i}+2\hat{j}+3\hat{k}$

(1) $0,\frac{1}{\sqrt{5}},\frac{-2}{\sqrt{5}}$ (2) 0, 0, 0

(3) $\frac{1}{\sqrt{5}},\frac{-2}{\sqrt{5}},\frac{2}{\sqrt{5}}$ (4) 1, 1, –1

83. Three forces are acting on a particles as shown in the figure. To have the resultant forces only along the y-direction, the magnitude of the minimum additional force needed is :-



(1) 0.866 N (2) 1.732 N

(3) 0.5 N (4) 4 N

84. The force $\vec{F}=(\hat{i}+b\hat{j}+3\hat{k})$N is rotated through an angle α, then it becomes $\{2\hat{i}+(2b-1)\hat{j}+\hat{k}\}$N. The value of b is :-

(1) 2 (2) $-\frac{2}{3}$

(3) $\frac{2}{3}$ (4) Both (1) and (2)

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DOT PRODUCT

85. If $\vec{P}.\vec{Q} = -PQ$, then angle between $\vec{P}$ and $\vec{Q}$ is :
(1) 0° (2) 180° (3) 45° (4) 60°

86. A force $\vec{F}=(2\hat{i}+3\hat{j})$N acts on a body and displaces it by $\vec{S}=(3\hat{i}+4\hat{j})$m. The work done $(W=\vec{F}\cdot\vec{S})$ by the force is :
(1) 10J (2) 12J (3) 18J (4) 25J

87. A force $(2\hat{i}+2\hat{j})$N displaces an object through a distance $(2\hat{i}-3\hat{j})$m. The work $(W = \vec{F}\cdot\vec{S})$ done is:
(1) –2J (2) 12J (3) 5J (4) 13J

88. A force of 14 N acts on a particle along the vector $(3\hat{i}+2\hat{j}-6\hat{k})$. If the particle displaces from (0, 0, 0) to (2, 4, –2), the work $(W=\vec{F}\cdot\vec{S})$ done by force on the particle is :-
(1) 10J (2) 52J (3) –48J (4)14 J

89. If a vector $(2\hat{i}+3\hat{j}+8\hat{k})$ is perpendicular to the vector $(4\hat{i}-4\alpha\hat{j}+\alpha\hat{k})$, then the value of α is :
(1) –1 (2) 1/2 (3) –1/2 (4) 2

90. The vector $\vec{P}=a\hat{i}+a\hat{j}+3\hat{k}$ and $\vec{Q}=a\hat{i}-2\hat{j}-\hat{k}$ are perpendicular to each other. The positive value of a is :
(1) 3 (2) 2 (3) 1 (4) zero

91. A vector perpendicular to $(4\hat{i}+3\hat{j})$ may be :
(1) $4\hat{i}+3\hat{j}$ (2) $7\hat{k}$
(3) $6\hat{i}$ (4) $3\hat{i}+4\hat{j}$

92. Let $\vec{A}=\hat{i}A\cos\theta-\hat{j}A\sin\theta$, be any vector. Another vector $\vec{B}$ which is normal to $\vec{A}$ is :
(1) $\hat{i}B\cos\theta+\hat{j}B\sin\theta$ (2) $\hat{i}B\sin\theta+\hat{j}B\cos\theta$
(3) $\hat{i}B\sin\theta-\hat{j}B\cos\theta$ (4) $\hat{i}A\cos\theta-\hat{j}A\sin\theta$

93. If $\vec{a}+\vec{b}$ is perpendicular to $\vec{a}$ and $(2\vec{a}+\vec{b})$ is perpendicular to $\vec{b}$. Then, $\frac{|\vec{b}|}{|\vec{a}|}$ is :-
(1) 0 (2) $\sqrt{2}$
(3) 1 (4) $\frac{1}{\sqrt{2}}$

94. If $\hat{n}=a\hat{i}+b\hat{j}$ is perpendicular to the vector $(\hat{i}-\hat{j})$, then the value of a and b may be :
(1) 1, 0 (2) –2, 0
(3) 3, 0 (4) $\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}$

95. The vector sum of two forces is perpendicular to their vector difference. In that case, the force :
(1) Are equal to each other.
(2) Are equal to each other in magnitude.
(3) Are not equal to each other in magnitude.
(4) Cannot be predicted.

96. Given that A = B and $\vec{A}\perp\vec{B}$. What is the angle between $(\vec{A}+\vec{B})$ and $(\vec{A}+\vec{B})$?
(1) 30^0 (2) 60^0
(3) 90^0 (4) 180^0

97. A parallelogram is formed with $\vec{a}$ and $\vec{b}$ as the sides. Let $\vec{d}_1$ and $\vec{d}_2$ be the diagonals of the parallelogram. The value of $a^2 + b^2$ is :-
(1) $d_1^2+d_2^2$ (2) $\frac{d_1^2+d_2^2}{2}$
(3) $(d_1+d_2)^2$ (4) $d_1^2+d_2^2+d_1d_2$

98. The angle between the two vectors $\vec{A}=3\hat{i}+4\hat{j}+5\hat{k}$ and $\vec{B}=6\hat{i}+8\hat{j}+10\hat{k}$ will be :
(1) 0° (2) 180° (3) 90° (4) 45°

99. What is the angle between $\vec{A}$ and the resultant of $(\vec{A}+2\hat{B})$ and $(2\vec{A}-2\hat{B})$?
(1) 0° (2) $\tan^{-1}\left(\frac{A}{B}\right)$
(3) $\tan^{-1}\left(\frac{B}{A}\right)$ (4) $\tan^{-1}\left(\frac{A-B}{A+B}\right)$

100. The angle between vectors $(\hat{i}+\hat{j})$ and $(\hat{i}+\hat{k})$ is:
(1) 90^0 (2) 180^0 (3) 0^0 (4) 60^0

101. The angle between $2\hat{i}+\hat{j}+2\hat{k}$ and $\hat{i}-\hat{j}+\hat{k}$ is :-
(1) 30° (2) 60°
(3) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$ (4) $\cos^{-1}\left(\frac{2}{3}\right)$

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102. What is the projection of $3\hat{i}+4\hat{k}$ on the z-axis ?
(1) 3 (2) 4 (3) 5 (4) zero

103. What is the projection of $\vec{B}$ on $\vec{A}$?
(1) $\vec{A}.\vec{B}$ (2) $\vec{A}.\hat{B}$ (3) $\vec{B}.\hat{A}$ (4) $\hat{A}.\hat{B}$

104. What is the component $(3\hat{i}+4\hat{j})$ to $(\hat{i}+\hat{j})$?
(1) $\frac{1}{2}(\hat{j}-\hat{i})$ (2) $\frac{3}{2}(\hat{j}+\hat{i})$
(3) $\frac{5}{2}(\hat{j}+\hat{i})$ (4) $\frac{7}{2}(\hat{j}+\hat{i})$

CROSS PRODUCT

105. If $\hat{i}, \hat{j}$ and $\hat{k}$ are unit vectors along X, Y & Z axis respectively, then tick the wrong statement :
(1) $\hat{i}\times\hat{i}=\vec{0}$ (2) $\hat{i}\times\hat{j}=\hat{k}$
(3) $\hat{i}.\hat{j}=1$ (4) $\hat{i}\times\hat{k}=-\hat{j}$

106. The magnitude of the vector product of two vectors $\vec{A}$ and $\vec{B}$ may be :
(1) Equal to 0 (2) Less than AB
(3) Equal to AB (4) All of above

107. If $\vec{P}\times\vec{Q}=\vec{R}$, then which of the following statements is true ?
(1) $\vec{R}\perp\vec{P}$ (2) $\vec{R}\perp\vec{Q}$
(3) $\vec{R}\perp(\vec{P}+\vec{Q})$ (4) All of above

108. Two vectors $\vec{P}$ and $\vec{Q}$ are inclined to each other at angle θ. Which of the following is the unit vector perpendicular to $\vec{P}$ and $\vec{Q}$?
(1) $\frac{\vec{P}\times\vec{Q}}{P.Q}$ (2) $\frac{\hat{P}\times\hat{Q}}{\sin\theta}$
(3) $\frac{\vec{P}\times\vec{Q}}{|\vec{P}\times\vec{Q}|}$ (4) Both 2 and 3

109. Which of the following vector identities is false ?
(1) $\vec{P}+\vec{Q}=\vec{Q}+\vec{P}$ (2) $\vec{P}\times\vec{Q}=\vec{Q}\times\vec{P}$
(3) $\vec{P}.\vec{Q}=\vec{Q}.\vec{P}$ (4) $\vec{P}\times\vec{Q}=-(\vec{Q}\times\vec{P})$

110. What is the value of $(\vec{A}+\vec{B})\times(\vec{A}-\vec{B})$?
(1) $-2(\vec{A}\times\vec{B})$ (2) $2(\vec{B}\times\vec{A})$
(3) $\vec{0}$ (4) both 1 and 2

111. The angle between vectors $(\vec{A}\times\vec{B})$ and $-(\vec{B}\times\vec{A})$ is:
(1) π rad (2) $\frac{\pi}{2}$ rad
(3) $\frac{\pi}{4}$ rad (4) zero

112. A vector $\vec{A}$ points vertically upward and $\vec{B}$ points towards south. The vector product $\vec{A}\times\vec{B}$ is
(1) zero
(2) along west
(3) along east
(4) vertically downward

113. If $\frac{3}{4}|\vec{A}\times\vec{B}|=|\vec{A}.\vec{B}|$, then the angle between $\vec{A}$ and $\vec{B}$ will be :
(1) 30° (2) 45° (3) 60° (4) 53°

114. If $\vec{A}=3\hat{i}+4\hat{j}$ and $\vec{B}=6\hat{i}+8\hat{j}$ and A and B are the magnitudes of $\vec{A}$ and $\vec{B}$, then which of the following is true ?
(1) $\vec{A}\times\vec{B}=\vec{0}$ (2) $\frac{A}{B}=2$
(3) $\vec{A}.\vec{B}=48$ (4) A = 10

115. Two non zero vectors $\vec{A}$ and $\vec{B}$ are such that $|\vec{A}+\vec{B}|=|\vec{A}-\vec{B}|$. Then select correct alternative
(1) $\vec{A}.\vec{B}=0$ (2) $\vec{A}\times\vec{B}=\vec{0}$
(3) $\vec{A}=\vec{0}$ (4) $\vec{B}=\vec{0}$

116. A vector $\vec{F}_1$ is along the positive Y-axis. If its vector product with another vector $\vec{F}_2$ is zero then $\vec{F}_2$ may be :-
(1) $4\hat{j}$ (2) $-(\hat{i}+\hat{j})$
(3) $(\hat{i}+\hat{k})$ (4) $-4\hat{i}$

117. If $\vec{A}\times\vec{B}=\vec{0}$ and $\vec{B}\times\vec{C}=\vec{0}$, then the angle between $\vec{A}$ and $\vec{C}$ may be :
(1) π (2) $\frac{\pi}{4}$
(3) $\frac{\pi}{2}$ (4) None

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118. The vector $\vec{B}=6\hat{i}+2\hat{j}+S\hat{k}$ is parallel to the vector $\vec{A}=3\hat{i}+\hat{j}+2\hat{k}$ if S =

(1) 1 (2) 4 (3) 6 (4) 8

119. If three vectors satisfy the relation $\vec{A}.\vec{B}=0$ and $\vec{A}.\vec{C}=0$, then $\vec{A}$ can be parallel to

(1) $\vec{C}$ (2) $\vec{B}$ (3) $\vec{B}\times\vec{C}$ (4) $\vec{B}.\vec{C}$

120. For a body, angular velocity $\vec{\omega}=\hat{i}-\hat{j}+\hat{k}$ and radius vector $\vec{r}=\hat{i}+\hat{j}+\hat{k}$, then its velocity $(\vec{v}=\vec{\omega}\times\vec{r})$ is:

(1) $-5\hat{i}+2\hat{j}+3\hat{k}$ (2) $-5\hat{i}+2\hat{j}+3\hat{k}$

(3) $-2\hat{i}+2\hat{k}$ (4) $-5\hat{i}-2\hat{j}-3\hat{k}$

121. Find unit vector perpendicular to the plane of $\vec{a}=2\hat{i}-2\hat{j}+\hat{k}$ and $\vec{b}=\hat{i}+2\hat{j}+2\hat{k}$

(1) $\frac{2}{3}\hat{i}+\frac{1}{3}\hat{j}+\frac{2}{3}\hat{k}$ (2) $-\frac{2}{3}\hat{i}-\frac{1}{3}\hat{j}-\frac{2}{3}\hat{k}$

(3) $-\frac{2}{3}\hat{i}-\frac{1}{3}\hat{j}+\frac{2}{3}\hat{k}$ (4) $\frac{2}{3}\hat{i}+\frac{2}{3}\hat{j}-\frac{1}{3}\hat{k}$

122. If $\vec{a}=\hat{i}+\hat{j},\vec{b}=\hat{k}-\hat{i}$ and $\vec{c}=\vec{a}+\vec{b}$.

Find $\vec{c}\times(\vec{a}-\vec{b})$.

(1) $\hat{i}+\hat{j}+\hat{k}$ (2) $-2\hat{i}+2\hat{j}-2\hat{k}$

(3) $2\hat{i}+\hat{j}-\hat{k}$ (4) $\hat{i}+\hat{j}-\hat{k}$

123. If $\vec{a}=(2\hat{i}-2\hat{j}+\hat{k})$ and $\vec{b}=(\hat{i}-2\hat{j}+\hat{k})$.

If $\vec{c}=\vec{a}\times\vec{b}$. Find the magnitude of $\vec{a}+\vec{b}+\vec{c}$.

(1) 34 units (2) $\sqrt{34}$ units

(3) 23 units (4) $\sqrt{23}$ units

124. The area of a triangle whose vertices are A(1, –1, 2)m, B(2, 1, –1)m and C(3, –1, 2)m is :-

(1) $13\,m^2$ (2) $8\sqrt{13}\,m^2$

(3) $\sqrt{13}\,m^2$ (4) $\sqrt{26}\,m^2$

125. Area of a parallelogram, whose diagonals are $\hat{i}+\hat{j}-2\hat{k}$ and $\hat{i}-3\hat{j}+4\hat{k}$ will be :

(1) $\sqrt{14}$ unit (2) $5\sqrt{3}$ unit

(3) $10\sqrt{3}$ unit (4) $20\sqrt{3}$ unit

126. If $\vec{a},\vec{b}$ and $\vec{c}$ are mutually perpendicular to each other. Then $|\vec{a}\times\vec{b}\times\vec{c}|$ is :-

(1) zero (2) 1 (3) abc (4) ab^2

127. If $\vec{a}=2\hat{i}-\hat{j}+\hat{k},\vec{b}=\hat{i}+2\hat{j}-3\hat{k}$ and $\vec{c}=3\hat{i}-y\hat{j}+5\hat{k}$ are coplanar.

Find the value of y.

(1) 2 (2) 3 (3) 4 (4) 5

EXERCISE-I (Conceptual Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	1	1	3	2	1	3	3	2	2	3	3	2	2	2	1
Question	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Answer	1	2	2	4	3	1	3	3	1	3	3	2	1	4	1
Question	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Answer	3	1	4	3	4	1	3	3	4	1	4	1	1	1	2
Question	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Answer	1	3	1	2	1	2	1	4	2	4	4	2	1	3	3
Question	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Answer	2	4	1	2	3	2	4	1	2	1	4	1	1	4	1
Question	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Answer	2	2	2	1	1	2	1	3	4	2	3	1	2	4	1
Question	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
Answer	2	2	2	4	2	3	2	1	1	4	3	2	3	1	3
Question	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
Answer	4	4	4	2	4	4	3	4	1	1	1	1	2	3	3
Question	121	122	123	124	125	126	127								
Answer	3	2	2	3	1	1	3								

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Exercise - II (Previous Year Questions) AIPMT/NEET

AIPMT 2006

1. The vectors $\vec{A}$ and $\vec{B}$ are such that $|\vec{A}+\vec{B}|=|\vec{A}-\vec{B}|$. The angle between vectors $\vec{A}$ and $\vec{B}$ is -

(1) 90° (2) 60° (3) 75° (4) 45°

AIPMT 2007

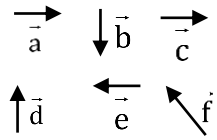
2. If $|\vec{A}\times\vec{B}| = \sqrt{3}\ \vec{A}.\vec{B}$, then the value of $|\vec{A}+\vec{B}|$ is :

(1) $\left(A^2+B^2+\frac{AB}{\sqrt{3}}\right)^{1/2}$ (2) A + B

(3) $(A^2+B^2+\sqrt{3}AB)^{1/2}$ (4) $(A^2+B^2+AB)^{1/2}$

AIPMT 2010

3. Six vectors, $\vec{a}$ through $\vec{f}$ have the magnitudes and directions indicated in the figure. Which of the following statements is true ?



(1) $\vec{b}+\vec{e}=\vec{f}$ (2) $\vec{b}+\vec{c}=\vec{f}$

(3) $\vec{d}+\vec{c}=\vec{f}$ (4) $\vec{d}+\vec{e}=\vec{f}$

Re-AIPMT 2015

4. If vectors $\vec{A}=\cos\omega t\hat{i}+\sin\omega t\hat{j}$ and $\vec{B}=\cos\frac{\omega t}{2}\hat{i}+\sin\frac{\omega t}{2}\hat{j}$ are functions of time, then the value of t at which they are orthogonal to each other is :

(1) t = 0 (2) $t=\frac{\pi}{4\omega}$

(3) $t=\frac{\pi}{2\omega}$ (4) $t=\frac{\pi}{\omega}$

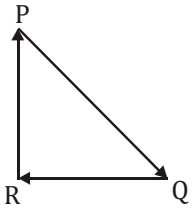
NEET-I 2016

5. If the magnitude of sum of two vectors is equal to the magnitude of difference of the two vectors, the angle between these vectors is :-

(1) 0° (2) 90° (3) 45° (4) 180°

NEET(UG) 2019

6. A particle moving with velocity $\vec{V}$ is acted by three forces shown by the vector triangle PQR. The velocity of the particle will :



(1) increase

(2) decrease

(3) remain constant

(4) change according to the smallest force $\overrightarrow{QR}$

RE-NEET(UG) 2022

7. If $\vec{F}=2\hat{i}+\hat{j}-\hat{k}$ and $\vec{r}=3\hat{i}+2\hat{j}-2\hat{k}$, then the scalar and vector products of $\vec{F}$ and $\vec{r}$ have the magnitudes respectively as :

(1) 5, $\sqrt{3}$ (2) 4, $\sqrt{5}$

(3) 10, $\sqrt{2}$ (4) 10, 2

EXERCISE-II (Previous Year Questions) ANSWER KEY

Question	1	2	3	4	5	6	7
Answer	1	4	4	4	2	3	3

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Exercise - III (Analytical Questions) Master Your Understanding

1. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.
Assertion (A) : Current has magnitude as well as direction but still not considered as vector.
Reason (R) : Current do not follow vector algebra.
In the light of the above statements, choose the most appropriate answer from the options given below:
(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.
(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.
(3) **(A)** is true but **(R)** is false.
(4) **(A)** is false but **(R)** is true.

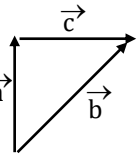
2. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.
Assertion (A) : Definite integral of a function is defined as area under the curve.
Reason (R) : Definite integral of a function is always positive.
In the light of the above statements, choose the most appropriate answer from the options given below:
(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.
(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.
(3) **(A)** is true but **(R)** is false.
(4) **(A)** is false but **(R)** is true.

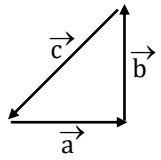
3. Two vectors $\vec{A}$ & $\vec{B}$ have equal magnitude equal to Z. If angle between $\vec{A}$ & $\vec{B}$ is 60° then match the following :

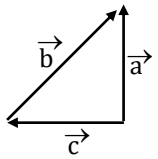
(A) $\left\|\vec{A}+\vec{B}\right\|$	(P) $\frac{\sqrt{3}}{2}Z^2$
(B) $\left\|\vec{A}-\vec{B}\right\|$	(Q) Z
(C) $\vec{A}\cdot\vec{B}$	(R) $\sqrt{3}Z$
(D) $\left\|\vec{A}\times\vec{B}\right\|$	(S) None

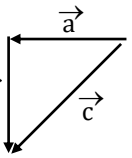
(1) (A)–(R), (B)–(S), (C)–(Q), (D)–(P)
(2) (A)–(R), (B)–(Q), (C)–(S), (D)–(P)
(3) (A)–(P), (B)–(Q), (C)–(R), (D)–(S)
(4) (A)–(Q), (B)–(P), (C)–(S), (D)–(P)

4. Match the following

(A) $\vec{a}+\vec{b}=\vec{c}$ (P) 

(B) $\vec{a}-\vec{c}=\vec{b}$ (Q) 

(C) $\vec{b}-\vec{a}=\vec{c}$ (R) 

(D) $\vec{a}+\vec{b}+\vec{c}=\vec{0}$ (S) 

(1) (A)–(S), (B)–(R), (C)–(P), (D)–(Q)
(2) (A)–(R), (B)–(S), (C)–(Q), (D)–(P)
(3) (A)–(P), (B)–(Q), (C)–(R), (D)–(S)
(4) (A)–(S), (B)–(R), (C)–(Q), (D)–(P)

5. Given below are two statements :
Statement I : Resultant of 2 forces of magnitude 4N and 5N can be 2N in magnitude.
Statement II : $\left|\left|\vec{a}\right|-\left|\vec{b}\right|\right| \le \left|\vec{a}+\vec{b}\right| \le \left|\vec{a}\right|+\left|\vec{b}\right|$
In the light of the above statements, choose the most appropriate answer from the options given below :
(1) Both statement I and statement II are correct.
(2) Statement I is correct and statement II is incorrect.
(3) Statement I is incorrect and statement II is correct.
(4) Both statements I and statements II are incorrect.

6. Given below are two statements :
Statement I : Two null vector have same direction.
Statement II : $\vec{A}\times\vec{B}$ lies in the plane of $\vec{A}+\vec{B}$

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In the light of the above statements, choose the most appropriate answer from the options given below :

(1) Both statement I and statement II are correct.

(2) Statement I is correct and statement II is incorrect.

(3) Statement I is incorrect and statement II is correct.

(4) Both statements I and statements II are incorrect.

7. Which of the following is correct :

(i) $\vec{A}\cdot\vec{B}$ is a vector quantity

(ii) $\vec{A}\times\vec{B}$ is perpendicular to plane of $\vec{A}+\vec{B}$

(iii) For two orthogonal vectors $\vec{A}\cdot\vec{B}=0$

(iv)If vectors are parallel or antiparallel, then $\vec{A}\times\vec{B}=\vec{0}$

(1) (i) only

(2) (i) & (ii)

(2) (iii) & (iv) only

(4) (ii), (iii) & (iv)

8. Which of the following is incorrect :

(i) In third quadrant sin θ of angle is positive

(ii) For an increasing function $\frac{dy}{dx}>0$

(iii) Definite integral of a function gives magnitude of area between given limits

(1) (i) only (2) (ii) only

(3) (i) & (iii) (4) (iii) only

9. Given below are two statements :

Statement I : For every small angle θ, we may use approximation $\sin\theta \approx \theta \approx \tan\theta$.

Statement II : For very small angle θ, the hypotenuse and the base become approximately of the same length.

(1) Statement-I is true, Statement-II is true; Statement-II is a correct explanation for Statement-I.

(2) Statement-I is true, Statement-II is true; Statement-II is not a correct explanation for Statement-I.

(3) Statement-I is true, Statement-II is false.

(4) Statement-I is false, Statement-II is true.

10. Suggest suitable match between function given in the first column and its description given in the second column.

Column-I	Column-II
(A) sin(390°)	(P) Positive
(B) sin(–30°)	(Q) Negative
(C) cos 120°	(R) Zero
(D) tan (–120°)	(S) Modulus is greater than one
	(T) Modulus is less than one

(1) A → PT, B → QT, C → QT, D → PS

(2) A → PT, B → QS, C → QT, D → PS

(3) A → QT, B → QS, C → PT, D → PS

(4) A → QS, B → PT, C → QT, D → PS

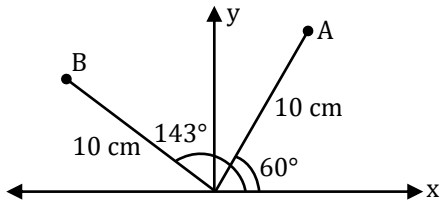
11. Refer the given figure and identify correct statement(s)

(A) Distance of A from x-axis is $5\sqrt{3}$ cm.

(B) Distance of B from x-axis is 6 cm.

(C) Distance of A from y-axis is 5 cm.

(D) Distance of B from y-axis is 8 cm.

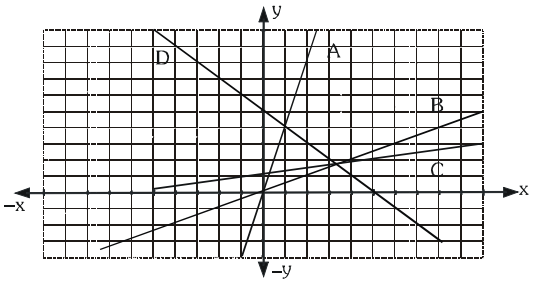


Options :-

(1) A, C (2) A, D

(3) A, B, C (4) A, B, C, D

12. In the following graph, several straight lines are shown. Arrange them in order of increasing slope modulus



Options :-

(1) C, B, A, D (2) C, B, D, A

(3) A, D, B,C (4) D, A, B, C

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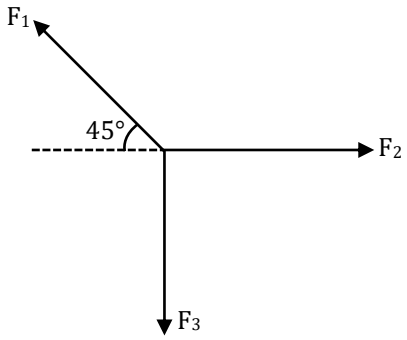
13. Three forces $\vec{F}_1$, $\vec{F}_2$ and $\vec{F}_3$ are represented as shown. Each of them is of equal magnitude.



Column I (Combination)	Column II (Approximate Direction)
(A) $\vec{F}_1+\vec{F}_2+\vec{F}_3$	(P)
(B) $\vec{F}_1-\vec{F}_2+\vec{F}_3$	(Q)
(C) $\vec{F}_1-\vec{F}_2-\vec{F}_3$	(R)
(D) $\vec{F}_2-\vec{F}_1-\vec{F}_3$	(S)

Options :-

(1) A → R, B → Q, C → P, D → S

(2) A → Q, B → P, C → R, D → S

(3) A → Q, B → R, C → P, D → S

(4) A → S, B → P, C → R, D → Q

14. Which of the following statement is/are true ?

(a) Two vectors of unequal magnitude can add up to zero.

(b) Three vectors of unequal magnitude can add up to zero, if they lie in a plane.

(c) Three vectors of unequal magnitude can added upto zero, if they do not lie in same plane.

Options :-

(1) Only a (2) a, b and c

(3) only b (4) only c

EXERCISE-III (Analytical Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Answer	1	3	2	1	1	4	4	3	1	1	4	2	3	3

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Important Notes